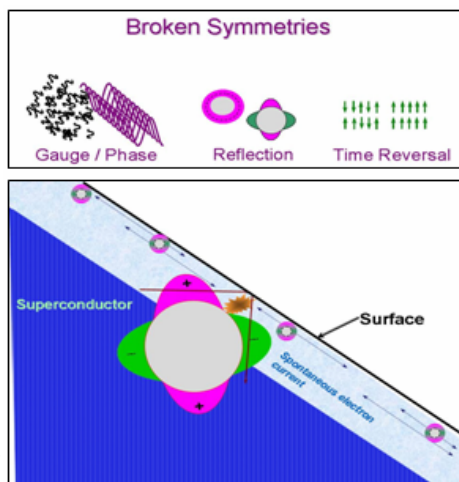




Center for Nanoscale
Chemical-Electrical-Mechanical
Manufacturing Systems

High Temperature Superconductors: Playgrounds for Broken Symmetries

Studies of symmetries and the consequences of breaking them have lead to deeper understanding in many areas of science. The high-temperature superconductors, discovered in 1986, motivated an unprecedented world-wide flurry of research: Not only because applications are promising, but because they also represent a fascinating new state of matter that breaks certain fundamental symmetries. After providing a general background on broken symmetries, Andreev reflection, and superconductivity, we show how planar tunneling spectroscopy can detect broken gauge (superconductivity), reflection (d-wave symmetry superconducting order parameter) and time-reversal (ferromagnetism) symmetries. These broken symmetries are measured by tunneling into quasiparticle Andreev bound states, which are nanoscale near-surface states that intrinsically form by Andreev reflections at symmetry breaking surfaces of unconventional superconductors. These quasi-one-dimensional quasiparticle states, embedded in the d-wave superconductor, exhibit intriguing transport properties.



Wednesday, December 5, 2007
4:00 pm
1000 MNTL

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Laura H. Greene, Swanlund Professor of Physics, received her PhD from Cornell and then worked at Bell Laboratories and Bellcore. She researches experimental condensed matter physics in strongly-correlated electron systems, focusing on novel superconductivity. Greene has served on the: International Union of Pure and Applied Physicists; Board of the Kavli Institute for Theoretical Physics; Basic Energy Sciences Advisory Committee (DoE); Sloan Fellowship Committee; Gordon Research Board of Trustees; and the Editorial board (EiC) for Reports on the Progress in Physics. For the American Physical Society she has been elected to Councils and Executive Boards. She serves on studies for the National Academy of Sciences, the National Science Foundation, and has chaired tens of conferences. She is dedicated to education, outreach, and to improving the status of women and minorities in physics. Greene is a member of the National Academy of Sciences, a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the American Physical Society, and the Institute of Physics (UK). She received the Maria Goeppert-Mayer Award from the APS and the E. O. Lawrence Award from the DoE. She has co-authored over 150 publications and given over 300 invited talks.